Chromosome Numbers in Some Himalayan Species of Vittaria

S. S. BIR

Vittaria J. E. Smith, the type genus of the family Vittariaceae, according to Beddome (1892) is represented by only four species in India, but his is by no means a complete listing, because as as many as seven species have been collected by the writer from the Sikkim-Darjeeling Himalayas alone. These are *V. himalayensis* Ching, *V. ophiopogonoides* Ching, *V. Doniana* Mett., *V. elongata* Swartz, *V. flexuosa* Fée,[1] *V. sikkimensis Kuhn*, and *V. scolopendrina* (Bory) Thwaites. The first three species mentioned above are additions to Beddome's list for the Himalayas. Of these, *V. himalayensis* and *V. Doniana* are endemic in the Eastern Himalayas. Except for *V. scolopendrina*, all of these are quite common in the area. Nearly all have grass-like leaves and are taxonomically difficult because of the narrow and minute specific differences. A taxonomic account will be published elsewhere.

MATERIALS AND METHODS

Vittarias are exceptionally difficult cytologically owing to the profusion of paraphyses which cannot be separated readily from the sporangia. These globular paraphyses greatly impede the proper flattening and adhesion to the slide of spore-mother-cells, which wash away while the slide is being made permanent. The meiosis has been studied in three of the Himalayan species following the usual acetocarmine squash method. The modified Carnoy's Fluid (1 part acetic acid, 3 parts absolute alcohol and 4 parts chloroform) gives better results than 1 to 3 acetic alcohol, as it helps to clear the spore-mother-cells of stored food materials.

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[1] This species was included by Hooker and Baker (1874) and Beddome (1892) under *V. lineata* (L.) J. E. Smith, a tropical American species and the type of the genus. Fée (1851-52) separated the Indian plant under the name of *flexuosa*. In *V. lineata* the midrib is not raised as in *V. flexuosa* and the scales are more strongly toothed.

OBSERVATIONS

Vittaria himalayensis and *V. flexuosa* are high altitude ferns and are met with between 8,000 and 10,000 feet, whereas *V. ophiopogonoides* is the commonest species of the genus between 4,000 and 6,000 feet elevation. These three species belong to the Euvittaria group of Benedict (1911), characterized by the dorsiventral rhizome and distichous leaves. In all of these three species the sori are present in an extra-marginal groove. The present observations are summarized in the following table:

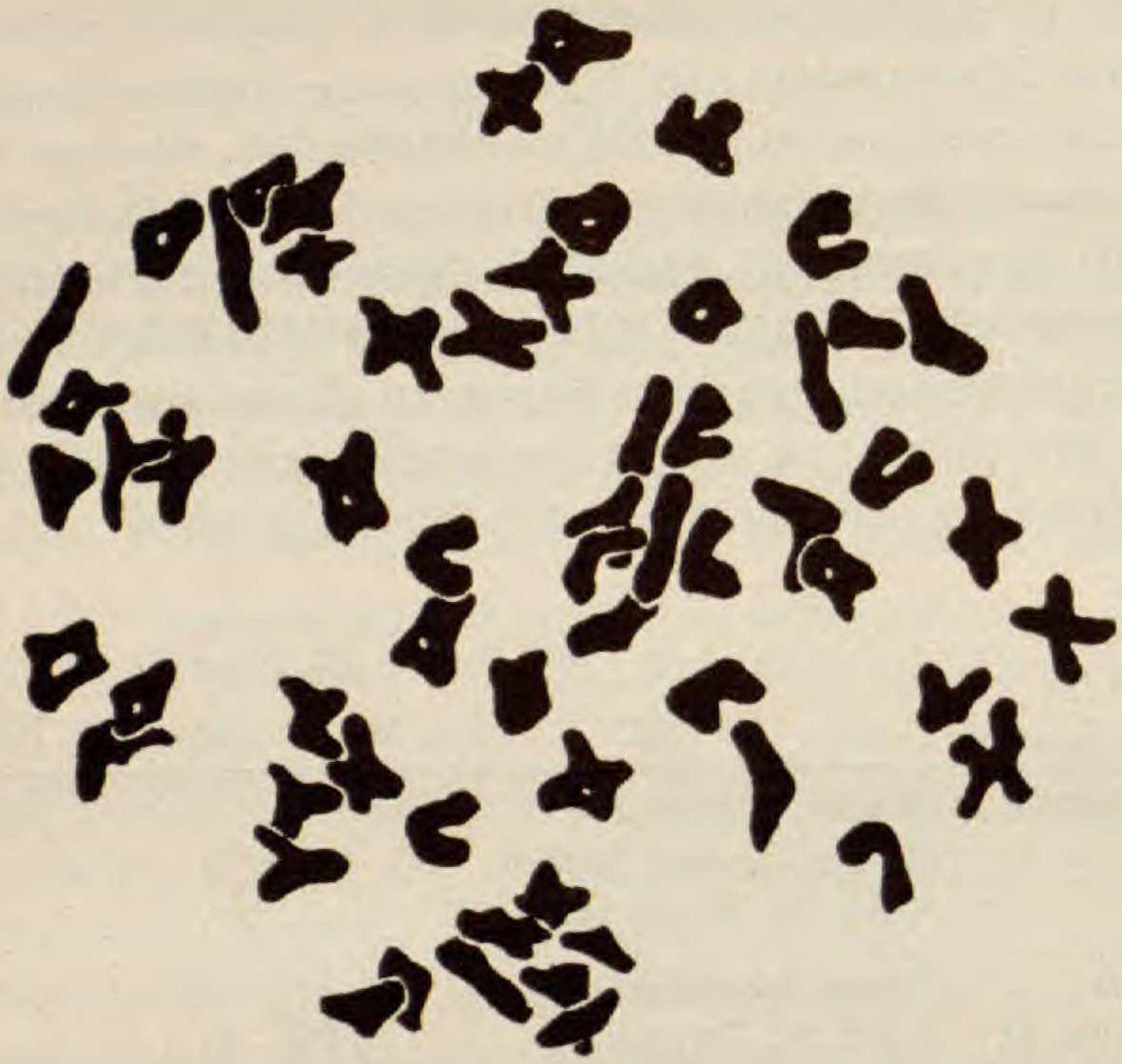
Name	Locality	Chromosome Number[2] n	$2n$	Polyploidy
V. himalayensis	Tonglu, 10,000 ft., Darjeeling and Lachen, 8,000 ft., North Sikkim	60 (Fig. 1)		Tetraploid
V. flexuosa (=*V. lineata* of Beddome, 1892)	Tonglu-Sandakphu road, 8,000 ft., Darjeeling	60 (Fig. 2)	120	Tetraploid
V. ophiopogonoides	Lebong, 5,000 ft., Darjeeling and Chungthang, 6,000 ft., North Sikkim	60 (Figs. 3, 4)	120	Tetraploid

[2]The somatic number has been counted from tapetal or archesporial cells of the sporangium.

The course of meiosis is perfectly regular, resulting in the production of normal, bilateral, non-perisporiate spores.

DISCUSSION

So far, cytological information is available for only two species of the genus in other regions. Manton and Sledge (1954) reported $n=60$ and $n=120$ for *V. scolopendrina* (Bory) Thwaites (tetraploid) and *V. elongata* Swartz (octoploid) from Ceylon. It speaks very well for a higher grade of polyploidy in the tropics as compared with the Himalayan species growing in a temperate climate. Although no diploid species ($n=30$) has been reported so far, the genus can convincingly be considered to have $x=30$ as a basic number particularly because two other vittarioid



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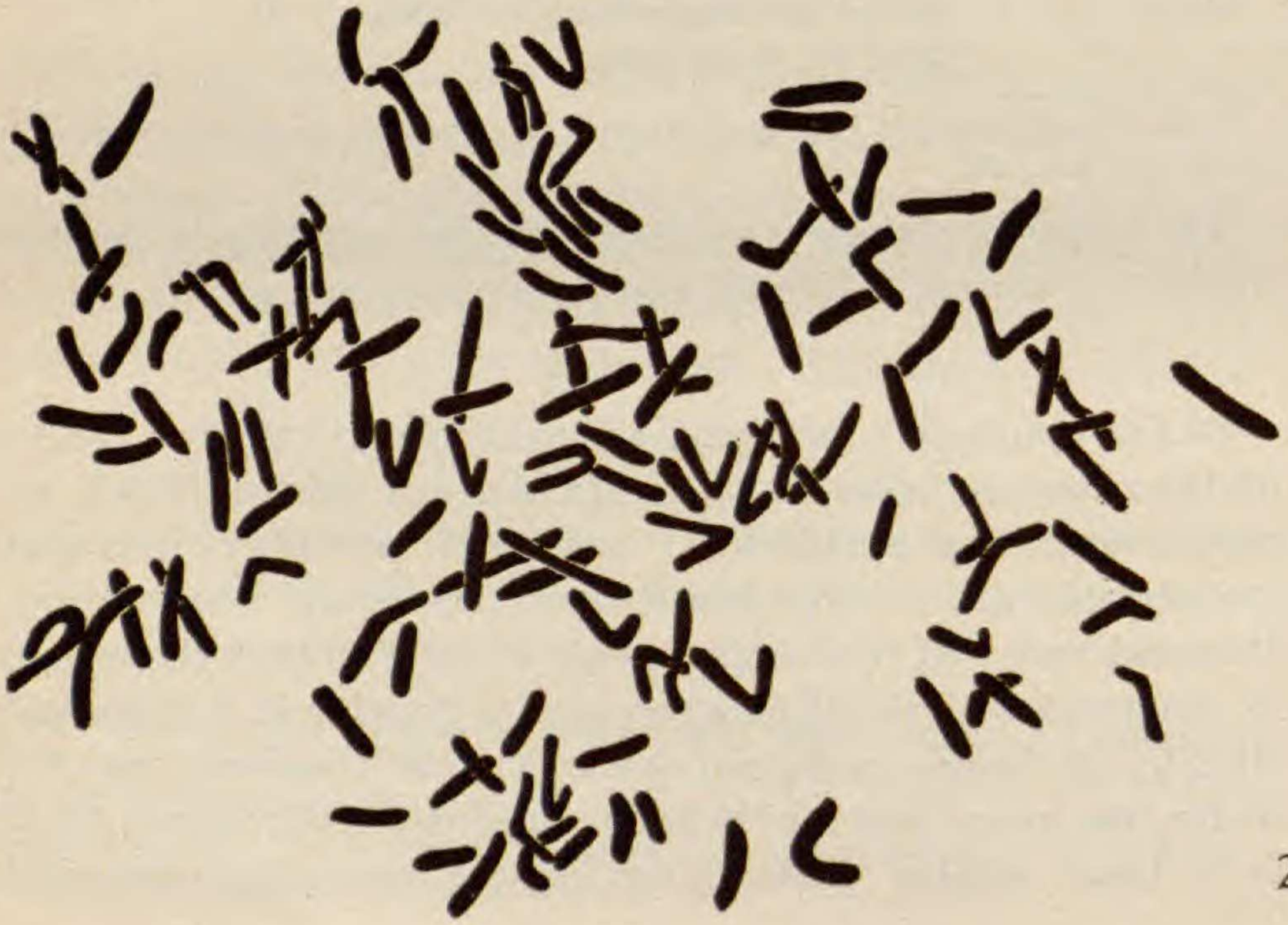

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genera, namely *Antrophyum* Kaulf., and *Monogramma* Schkuhr, are also based on $x=30$ (cf. Manton, 1954). Thus these three genera form a compact alliance cytologically. This justifies Copeland's (1947) merger of Ching's (1940) family *Antrophyaceae* (comprised of *Antrophyum* Kaulf., *Polytaenium* Desv., *Anetium* Splitg., and *Ananthacorus* Underw. and Maxon) in the family Vittariaceae. Most authors (Bower, 1928; Ching, 1940; Christensen, 1938; Holttum, 1946, 1949) regard vittarioid ferns as related to gymnogrammoid ferns. Furthermore, Holttum (1946, 1949 and 1954) groups these vittarioid genera (*Vittaria*, *Antrophyum*, and *Monogramma*) in the family Adiantaceae. Ample support to such a relationship is forthcoming from cytological data, because many of the gymnogrammoid genera (of Christensen, 1938; Ching, 1940, and Holttum, 1954) such as *Coniogramme* Fée, *Cryptogramma* R. Br., *Hemionitis* L., *Gymnopteris* Bernh., *Pityrogramma* Link, and *Adiantum* Linn., are predominantly based on $x=30$ (cf. Manton, 1950, 1958; Manton and Sledge, 1954).

Recently Copeland (1947) suggested that the Vittariaceae might have something in common with the Hymenophyllaceae because of the similarity of the prothallia, and further that *Crepidomanes* and *Didymoglossum* produce idioblasts suggestive of those of *Vittaria*. However, the cytological data do not support this view. According to Pichi-Sermolli (1957), the characteristic spicular cells of the epidermis (idioblasts) of the Vittariaceae are present in the genus *Adiantum* also. This feature and the same basic chromosome number of $x=30$ [although according to Manton and Sledge (1954) and Britton (1953) some species of *Adiantum* are based on 29 also] suggests a certain amount of affinity between *Vittaria* and *Adiantum*. But the pro-

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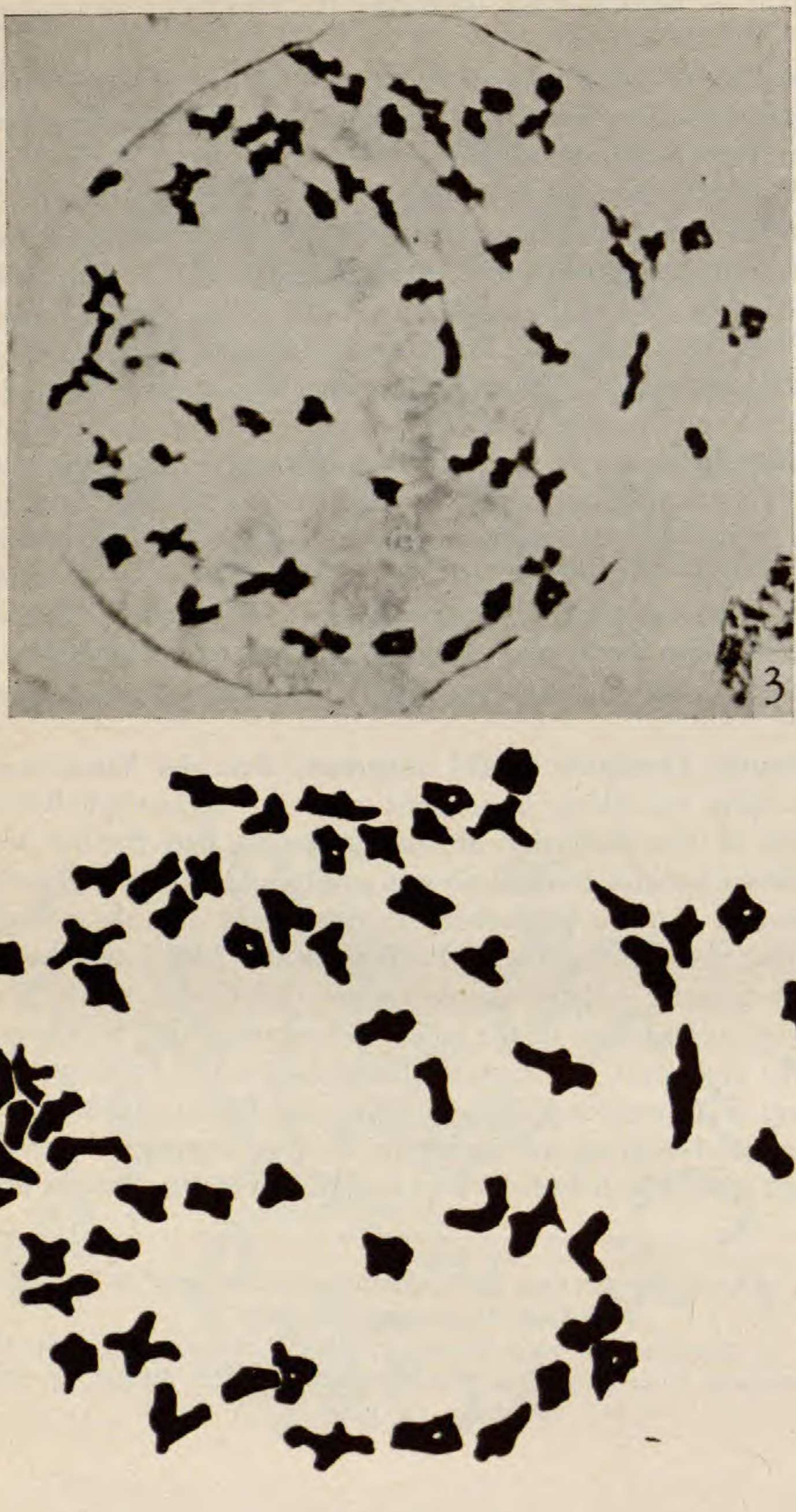
FIG. 1. A SPORE MOTHER CELL OF V. HIMALAYENSIS SHOWING 60 BIVALENTS AT LATE DIAKINESIS. × 2,000.

FIG. 2. A TAPETAL CELL FROM SPORANGIUM OF V. FLEXUOSA SHOWING 120 CHROMOSOMES DURING MITOSIS. CONSTRICTIONS MOSTLY MEDIAN OR SUBMEDIAN. × 1,300.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thallia in these two genera are markedly different. No other fern with a longitudinal annulus has prothallia of the *Vittaria* type (cf. Copeland 1947).

The affinities of vittarioid ferns with the gymnogrammoid genera (named above) are, however, not in any way so convincing as to make us think of their direct origin as from gymnogrammoid stock. On the contrary, as most aptly suggested by Pichi-Sermolli (1957), these two groups of ferns, the Vittariaceae and the Adiantaceae-Gymnogrammaceae of Ching, may represent independent lines which have probably originated from a comcon stock but have specialized along different lines. This is evident so far as the habitat is concerned, the Adiantaceae being terrestrial and the Vittariaceae mainly epiphytic. Therefore, the vittarioid ferns need to be separated from Holttum's family Adiantaceae.

Although at present the vittarioid ferns have received more careful study than many other groups, except for resemblances in a few characters with other ferns, they do not present any decisive evidence of their affinity with other groups of leptosporangiate ferns. Under the present circumstances they require family status, as indicated by Copeland. As regards their systematic position they may be placed near the gymnogrammoid ferns, as suggested by Christensen, Ching, and Holttum. Certainly they should not be placed after the polypodioid ferns as done by Copeland, because they have little resemblance with the latter group.

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FIG. 3. A SPORE MOTHER CELL OF V. OPHIPOPOGONOIDES WITH $n=60$. $\times$ 2,000.
FIG. 4. EXPLANATORY DIAGRAM OF FIG. 3. V. OPHIOPOGONOIDES, $n=60$. $\times$ 2,000.

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BOTANY DEPARTMENT, PANJAB UNIVERSITY, CHANDIGARH, INDIA.

Notes and News

ANNUAL MEETING:—The annual meeting of the American Fern Society will be held during the last week in August at Oregon State University, Corvallis, Oregon, in cooperation with the A.I.B.S. All members wishing to present papers at these